The Doubly Green Revolution: economy and institutions

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The Green Revolution has tried to fight against poverty and food shortages by selecting varieties and forcing systems of production on ecosystems, modified by massive use of fertilizers and pesticides. It has produced significant results but only in countries with high capacity production, water surpluses, and high population density.

The concept of a Doubly Green Revolution consists of shifting from one rationale of agricultural development based on a command of the environment to another, based on harmony with the ecosystems: working with and not against the variability of systems and putting the knowledge acquired from ecological sciences to use in agriculture.

It requires an interdisciplinary, intersectoral and spatialized approach. Current thought places agricultural development in an environmental vision of the sustainability of production systems.

It gives priority to local ecological, economic and social resilience[1] by rethinking the current relationships between central State and local institutions and by giving priority to a "bottom-up" approach in public choices and taxation schemes.

The Doubly Green Revolution aims to increase production without diminishing the environment's capacity or the bio-diversity for future generations. It adds to the objectives of the Green Revolution those of maintaining biological diversity and the resilience of ecosystems.

1 Resilience : capacity to return to the initial state after an external shock.

Issues and assessments

Poverty, hunger, deterioration of ecosystems

Currently, more than 700 million people live below the poverty line: three quarters of them live in rural areas. The most optimistic forecasts only predict a small decrease in this number by the year 2020.

In developing countries, 34% of the population were living in cities in 1990. By the year 2025, the figure will be up to 54%, with the total population more than doubling in the meantime.

The demand for food imports in developing countries could reach 400 million tons by the year 2025. It would take an additional 210 million tons of food to eliminate hunger.

Population growth combined with farming practices and the over-all organization of commerce and industry, the social structures and the property tax legislation can lead to the deterioration of ecosystems and their regenerative capabilities. Poverty and the institutional and economic organization also play a part in the process.

The economies of many countries are built on income from natural resources. They are extracted from the environment with no regard for the resilience of the ecosystems. The market favours this process because costs and prices do not internalise the deterioration of natural capital. Property legislation and authorities often worsen land tenure security for the poorest. In many countries, the State, guardian of renewable resources, lacks control capacities and cannot but rely on customary rights to limit access to public goods: the State ownership of resources often leads to the creation of de facto free access.

The virtues and limits of the Green Revolution

The Green Revolution is a rationale based on the command of the environment and the factors of variability. It aims to create a thorough artificialization of agricultural systems and seeks independence from climatic and biological variability.

It was mainly implemented in countries with water surpluses and high population densities—essential factors for its success in small farms. It has minimized the costs of gaining access to infrastructures, inputs and markets. After beginning with rice and wheat, it was later broadened to maize, groundnuts and cotton. The same rationale led to the intensification of herding in small farms and the development of aquaculture, also based on improving species and intensive production by bringing inputs into areas near markets.

The Green Revolution has experienced short-lived success in areas with water shortages and low population density. In such cases, and in the absence of limits

to land access, extensification seems less costly in terms of work and less risky than intensification. Though the Green Revolution was indeed technical, it was made possible by centralized incentive-based economic and institutional policies. Other factors of feasibility are the local existence of a market, high and stabilized agricultural prices, subsidies for inputs, large public services for supplying, marketing, extension and credit.

In areas where the Green Revolution achieved the success that was hoped, this very achievement has generated environmental costs not taken into account by the market: salination of soils and waterlogging in heavily irrigated areas, pollution by chemical inputs, loss of biological diversity particularly in local cultivars, decreased fertility and hydric erosion in areas ramfed agriculture.

Today, the Green Revolution has reached its limits. Not so much technically because it is still possible to improve crop varieties or input performance, but rather as a technical, institutional and economic system. We must find a new approach which doesn't only target areas of high density with water surpluses, but also agricultural areas where the Green Revolution has not taken place.

Towards a Doubly Green Revolution

Foundation and conditions of emergence

Another definition of the concept of intensification emerges. Rather than maximum yield under optimal conditions, we will be trying to achieve satisfactory yield at least economic and ecological cost under conditions of ecological and economic variability. The search for a least cost solution is consistent with the main objective of reducing poverty.

Advances in knowledge of ecology, economics, agronomy and the ethnological sciences, and progress made in modelling enable us to rethink the issue of rural development, based on the experience gained in the Green Revolution, taking advantage of what was learned, and going beyond its limits. This implies the total rethinking of rural development using a global approach and a "bottom-to-top"strategy.

Priority on social, ecological, economic and local resilience

In the Doubly Green Revolution, agriculture strives to manage an ecosystem in its entirety, including its relations with the human communities that live off it. It transforms this system irreversibly only if absolutely necessary. Priority will be given to low input techniques or the fight against risks by combining plants, and to the comprehensive management of local ecosystems, by moving away from the current dependence on a single plant such as cotton, rice or coffee.

Taking diversity and variability into account involves a "bottom-up" approach—from the local to the global level—made possible by advances in knowledge which allow us to move beyond the concept of production systems to a new concept of productive ecosystems. This change in basic concepts is necessary to take advantage of the diversity of local situations and to internalise the costs and the deterioration of "natural capital."

Internalising environmental costs

In a free-market economy, prices are not given *ex nihilo*. They are also management tools. Incorporating environmental costs in price systems is a necessary condition for the viable long-term management of ecosystems. Taking these costs into account will be all the more credible if it will be clearly perceived by local populations. Imposing taxes on resources extracted from the ecosystem can have the desired effect if it is accompanied by a turnaround in the traditional pattern of taxation: communities collect the tax, retain a percentage then forward the remainder to the State treasury.

A local tax, differentiated according to the fragility of the ecosystems, leads to a varying of prices from one market to the next which can spatially determine both demand and supply. For example, increasing the price of wood in peri-urban areas can encourage farmers to cultivate it. At the international level, only an agreement within the World Trade Organization (WTO) would allow environmental costs to be internalised into the price of export goods. Eco-labelling constitutes a necessary tool, although probably insufficient in the long-term.

The State and local institutions

The Doubly Green Revolution results in moving from an administrative rationale to one based on contracts between the State and local communities. Because of the obsession over property in economic thought, it was forgotten that customary rights can be secured and transferable in the framework of contracts with the State.

Projects have tended to ignore customary structures in order to stimulate groups of leaders who are supposed to spread innovations. The Doubly Green Revolution relies *inter alia* on customary structures, whether they are hierarchically or segmentally organized. It assumes that collective management of the access to resources and local collection of taxes are possible. It involves a major effort to ensure institutional representation at the local level. It acknowledges research and institutional actions as decisive sources of innovation. The bias against local adaptation condemns administrative development projects which bring local situations in line with general models. In their place, the Doubly Green Revolution provides for local co-manageed projects, governed by contracts between the State and local communities. The State becomes the facilitator and strategist of the development, thereby applying a principle of subsidiarity.

As concerns access to credit, in a context of liberalization, the State, as a facilitator, allows local forms of financing to become more widespread by ensuring the freedom of initiative and association. It spells out and enforces the rules of the game.

National and regional land use planning is one of the tools of this approach. The growth of cities, in a context of liberalization and elimination of administered prices, eventually generates a comparative advantage for urban hinterlands. Thinking in terms of locally viable development leads the State to play on local comparative advantages as the basis for its decisions.

- The risk is great to see regions far from cities shutting themselves off from the rest of the country and accepting subsistence, rural depopulation, or the over-exploitation of resources. In the rationale of the Doubly Green Revolution, a considerable part of research and development in these areas would be devoted to the cultivation of crops for food or industrial purposes. Comparative advantages within a country itself would be exploited in order to diversify production and markets which are economically, socially and ecologically viable.

- The construction of infrastructures, particularly those connected with transportation, is linked to development choices. A strategy based on the diversity of ecological potentials is in line with the integration of the national economy, if and only if goods can move about freely from one area to another. For this to be possible, many countries will have to continue to rely on foreign assistance.

Another approach of agricultural research

The local ecosystem is no longer just support for production, but becomes the foundation for productive choices. This change introduces more complexity into research and also provides possibilities to considerably diversify the supply of agricultural goods by utilizing genetic, specie and ecosystem diversity. The result of this could be putting into perspective the world food risk due to the small number of specie cultivated world-wide. Hence, numerous local plant and animal species could be domesticated. They have the same or better food, industrial and pedological properties as current species. Advances in research on bio-diversity must be exploited by agricultural research.

Current research defines scientific models in stations and asks farmers to test them under real life conditions.

In the Doubly Green Revolution, research begins with the farmers' knowledge base, tests and improves it, remaining in the perspective of global management of local ecosystems of which farmers are a part. Technical research models should be adapted locally and productive choices made first as a function of the capacity of the local ecosystem to be ecologically and socially resilient. These are two different ap-

proaches based on different objectives: controlling variability in the case of research and adapting *to* variability in the case of local varieties[2]. The Doubly Green Revolution calls for interdisciplinary research.

Towards viable long-term development

The approach provided by the Doubly Green Revolution takes advantage of the complexity, the diversity and the economic and social variability of ecosystems. It is rooted in research on viable long-term development which takes the greatest possible advantage of ecosystems under variable economic and social conditions without burdening its reproductive capacities. Thus the approach provided also aims to limit any irreversible effects.

The Doubly Green Revolution should be based on:

- Adapting technical models to various local situations. Local skills should be fully taken into account in scientific evaluation allowing their validation and the evaluation of their performance.
- Incorporating eating habits as a lever for crop diversification. The fact that more than 50% of the world's food is based on three plants cannot, in a context of probable climatic changes, be viable in the long-term. The Doubly Green Revolution opposes the growing homogenization in the way people eat and live around the world. Its goal is the diversification of supply and growth of local markets; globalization is not in contradiction with their diversity.

Furthermore, the Doubly Green Revolution postulates that cultural and social diversity are just as rich as biological diversity. It is not compatible with rationales based on centralized organization and uniformity. It is, however, consistent with the Universal Declaration of Human Rights, recognized legally by all the member States of the United Nations Organization. It has also been echoed in the president of the World Bank's "country focus" doctrine.

The globalization and liberalization of markets provides both benefits and risks for local producers and for the poorest:

- Benefits to the extent that they connect local markets into world markets and break down commercial monopolies;
- Risks to the extent that they result in important fluctuations in producer prices;
- Risks due to the standardization of eating habits based on a small number of species and genes.

2 In this respect, research tends to update short-cycle and water saving varieties. At the same time, local communities have chosen variable-cycle varieties as a function of the availability of water.

An alternative to the food risk and the instability of prices involves creating new, more local markets that reflect the diversification of crop and animal species, and are consistent with economic resilience and the upkeep of bio-diversity. The feasibility of diversification is more commercial than technical: it requires creating demand for supply to exist.

The globalization of markets is conducted in the context of a reduction of input subsidies and elimination of administered prices in the face of strong urban growth, the progressive impoverishment of rural zones and the deterioration of ecosystems. The Doubly Green Revolution constitutes a possible solution to the unprecedented challenge that the world now faces.

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Comments and debates

President : Saydil Moktar Toure

U. LELE: In order to stimulate the debates, I am going to try to be quite contrary. Michel Griffon presented an extremely comprehensive paper which covers a large number of areas. So it is impossible to discuss everything. I will pick out a few points.

I think the Green Revolution in Asia is only one case of a Green Revolution. I don't know if we can say that there is only one model. I don't even know what its significance is for Africa where the situations are so different from Asia. But to the extent that one tries to say "this is what happens in a Green Revolution" focusing on Asia, I as an Asian woman, hope that we learned the right lessons. We try to interpret history in a way which is meaningful for Africa, but I don't really know whether it is possible.

For the Green Revolution in Asia, we had the technologies which affected the scale economies; but in Africa for the Doubly Green Revolution, you don't. This has major implications on how research is organised.

Ironically Asia used to be described as a continent with "soft" states. But in retrospect, one would have to say that compared to what you see now in Africa, the State was very strong at least in India, Indonesia, Malaysia and the Philippine. And this so-called "soft" State had a very important role to play from the point of view of developing the political will to solve the food problem. But we don't know what it means to have political will to solve the very complex problems of the Doubly Green Revolution. We have to address the question of political will, which in the Asian context was driven by the fact that continuous shortages of food had very profound implications for